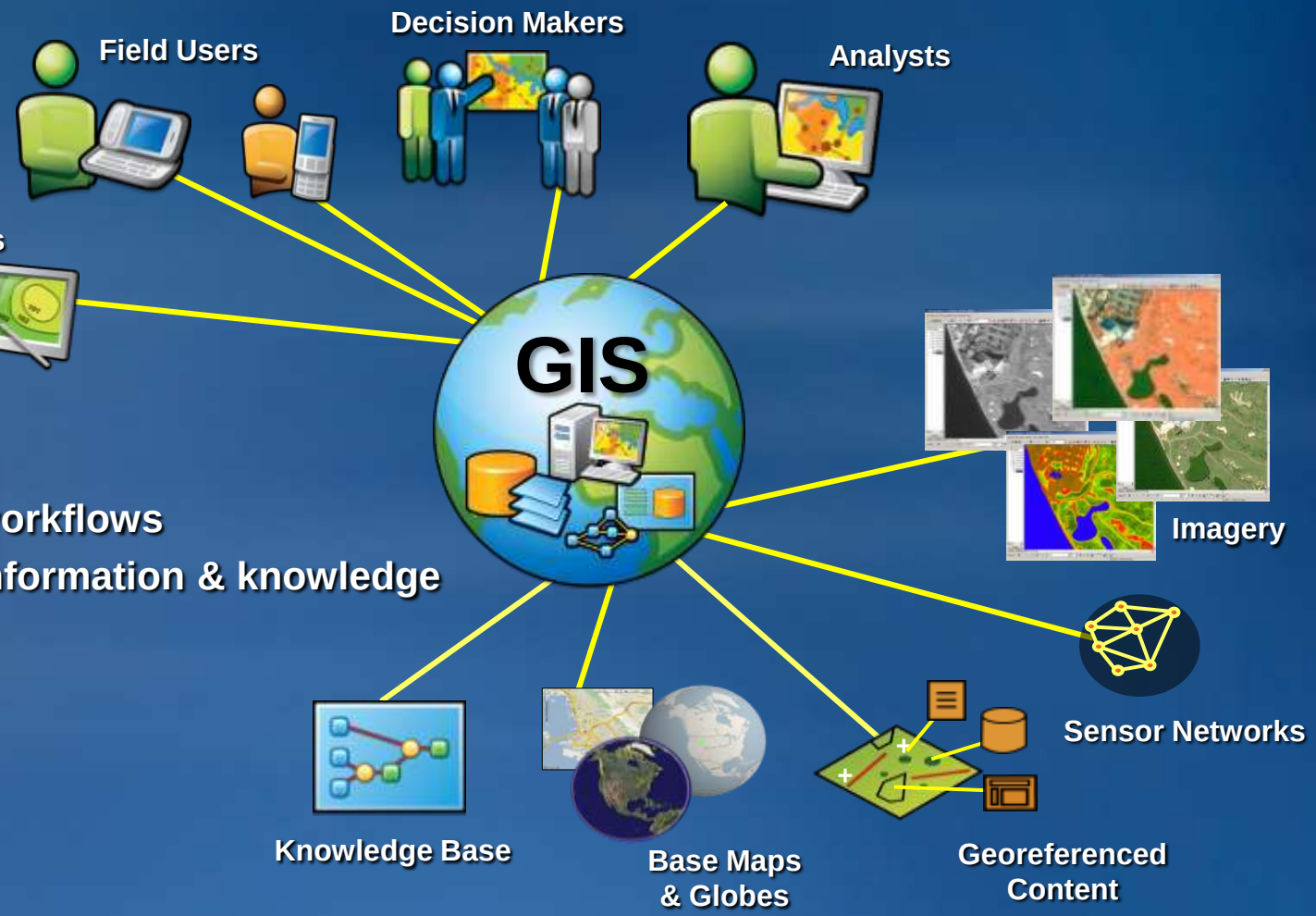
Imagery in ArcGIS

Peter Becker

Geospatial Information, Integrated & Accessible



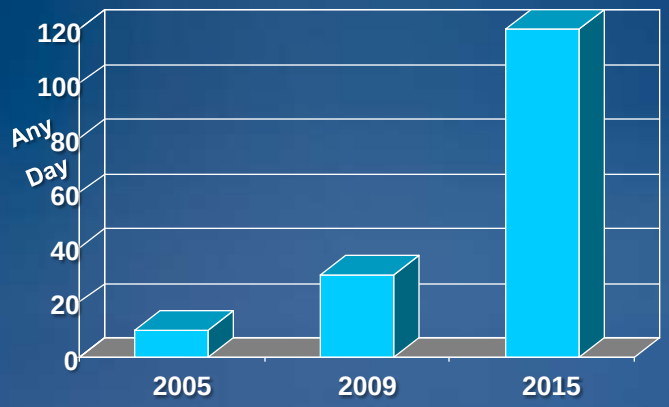
- Geospatial workflows
- Actionable information & knowledge

Imagery is Core to GIS

Trends in Imagery

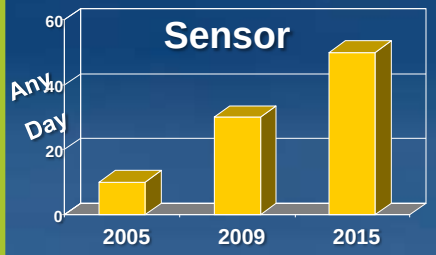
Entering the Platinum Age of Imagery

Volume

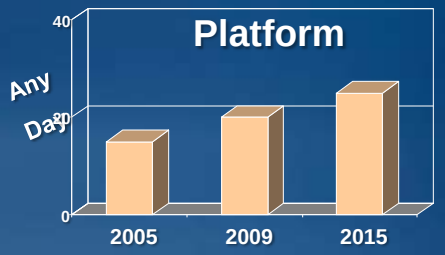


Amount of imagery stored

Variety



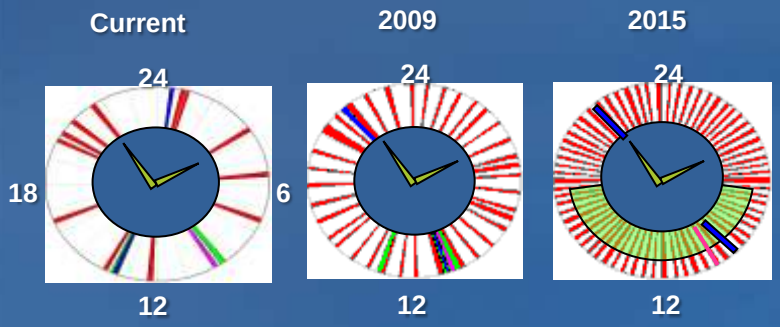
EO → AGI



Space →

- Air
- Ground
- Space
- Internet

Currency



Demand for current data

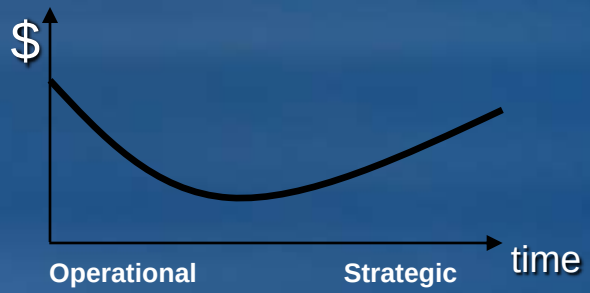
Accuracy

Improved positional accuracy and pixel resolution

Three Differentiators of Imagery

- **Volume:**
  - Magnitudes larger then other data

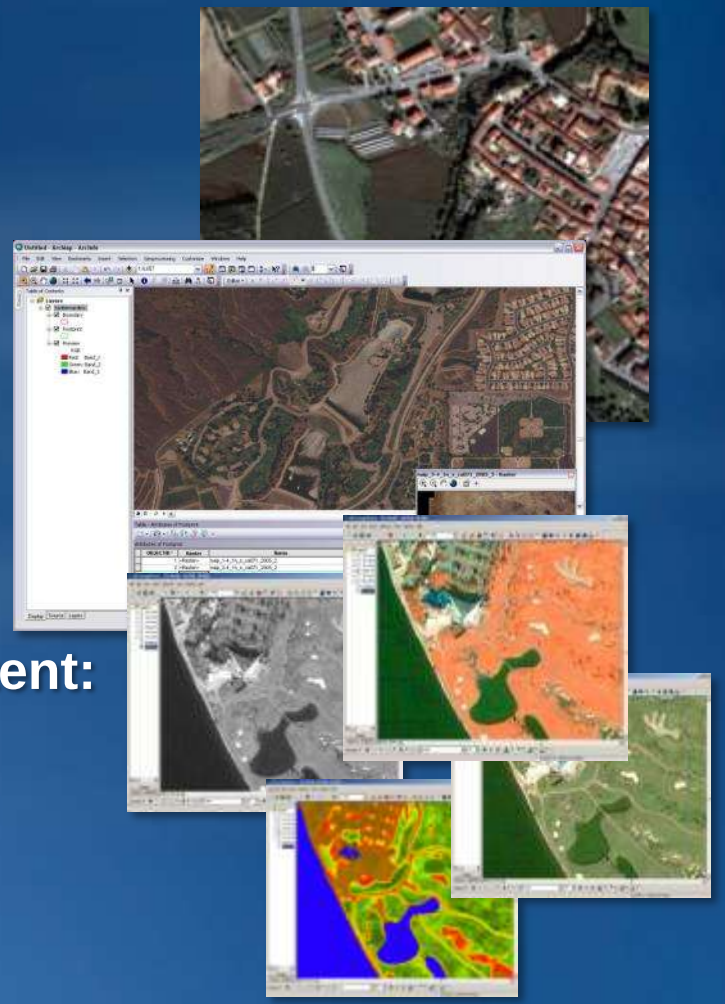
- **Value:**
  - High operational value
  - High strategic value



- **Fixed:**
  - A snapshot in time

ArcGIS – Maximizing the Value of Imagery

- **Providing Image Accessibility:**
  - Timely
  - Quickly
  - Accurately
  - Collectively
  - Simply
- **Exploiting Rich Information Content:**
  - Resolution
  - Temporal change
  - Spectral range
  - Dynamic range

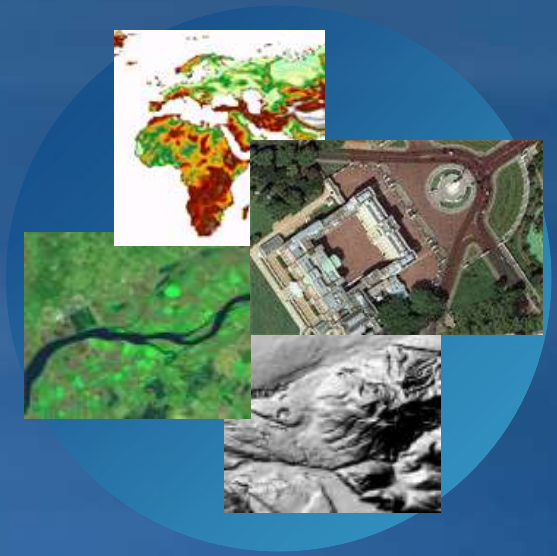


Elements of a Complete GIS

- Content
  - Base data
  - Volumes of data that it accessible
- Management
  - Storing, Organizing and Structuring
- Dissemination
  - Accessibility to data, information and knowledge
- Visualization
  - Interpretability and human understanding
- Analysis
  - Gain knowledge to make informed decisions

Imagery Content

Base Data Provided by Esri



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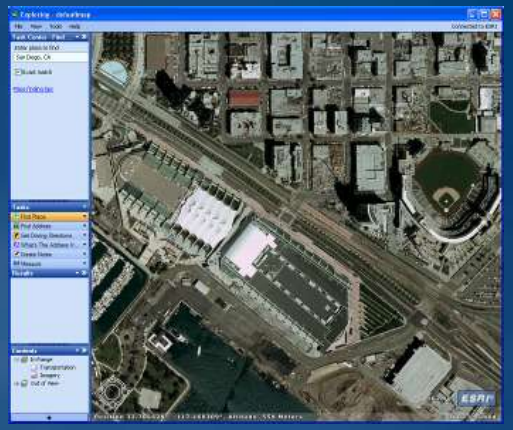
World Imagery

- Worldwide Imagery at 15m Resolution
- United States Imagery 1m or better
  - Updates to over 50% of United States
  - New Sub-meter Imagery in Metro Areas
    - Formerly available by subscription only
- International
  - GeoEye IKONOS Imagery for Major Metro Areas
  - Expanded Imagery for other Countries
    - GreatBritain, Belgium, France,

      Germany, Czech Republic,

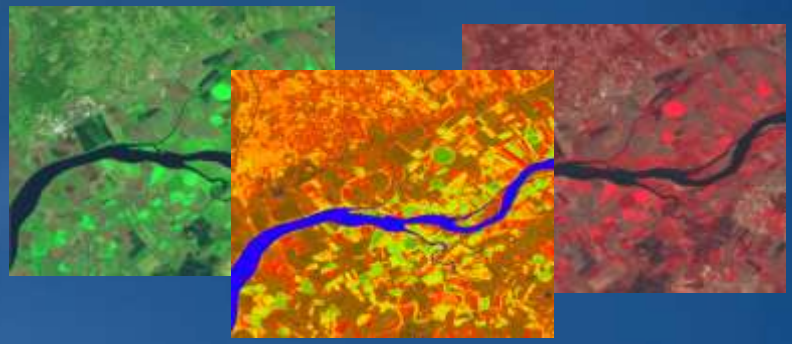
      Luxembourg, Netherlands, Portugal
- Community Map Program



World Landsat Imagery

To be added to ArcGIS.com

- **NaturalVue (from *MDA*)**
  - **Color Balanced, Orthorectified mosaic**



- **Global Landsat GLS**
  - **1980, 1990, 2000, 2005**
  - **Image Services**
    - **L1T, Radiance, TOA-Reflectance, Surface Reflectance**
    - **8band, Color 321, False Color 432, PsudoColor 742, NDVI**

World Elevation

To be added to ArcGIS.com

- **Multi Source**
  - GTOPO, SRTM,
  - USGS NED (1 and 1/3 arcsecond)
  - Lidar for sample areas
  - EGM2008 Geoid model
- **Services**
  - Elevation Orthometric & Ellipsoidal
  - Hill Shade, Slope, Aspect, Shaded Relieve
- **Tasks**
  - Profile, Viewshed, Contour

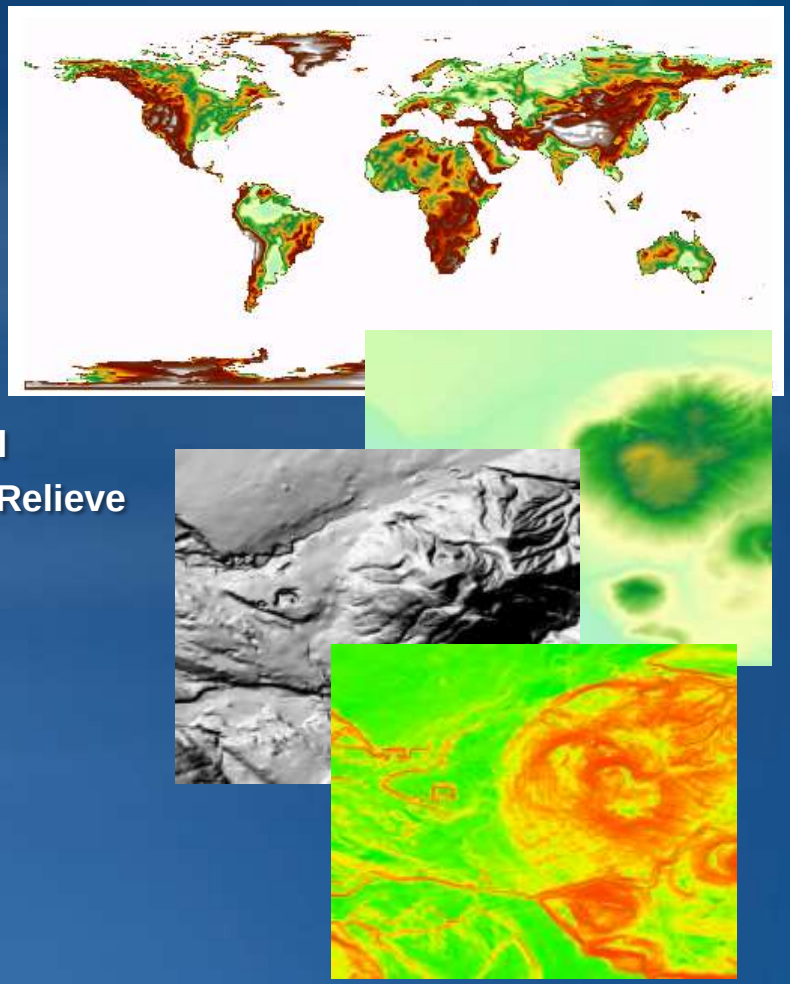
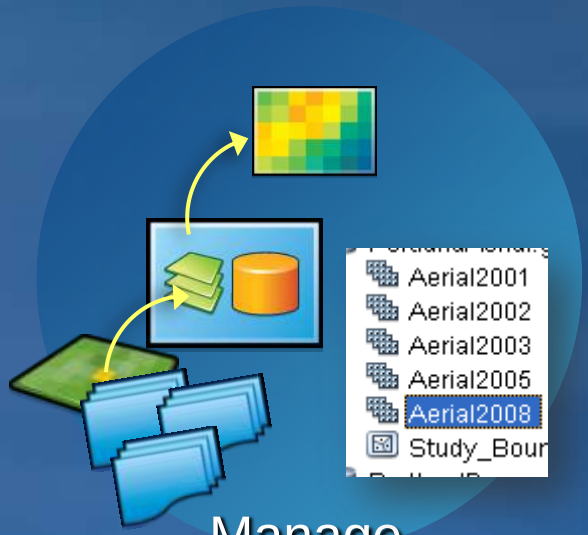


Image Management



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ArcGIS – For Image Data Management

Storage, Catalog, Metadata & Process

- Workstation User

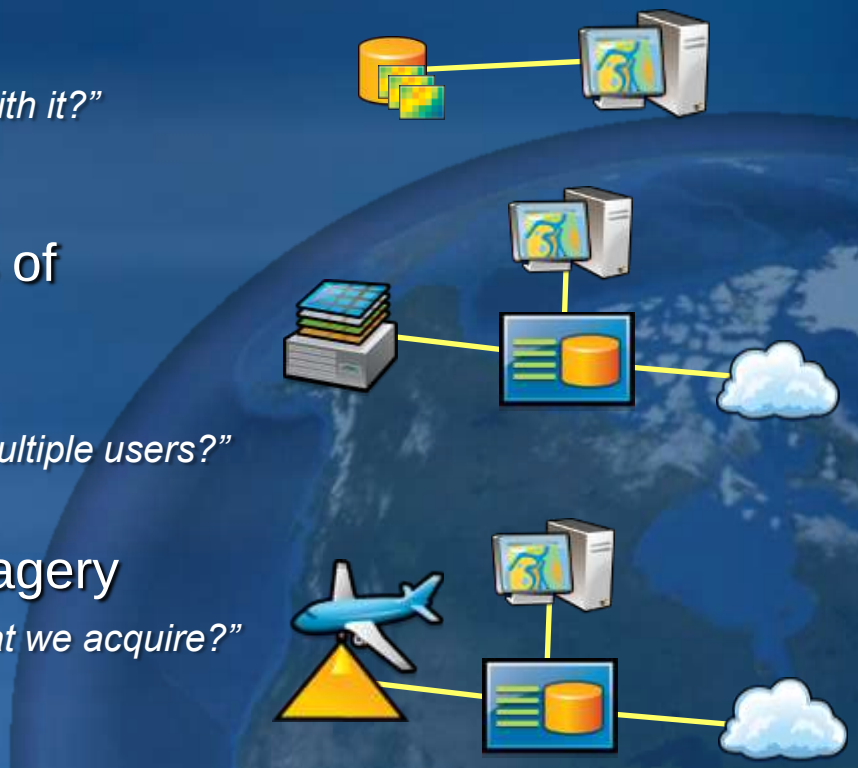
  "What do I have? How can I easily work with it?"

- Organizations with collections of processed imagery

  "How do I serve all our ortho images?"
  "How can I server my elevation data to multiple users?"

- Enterprises collecting new imagery

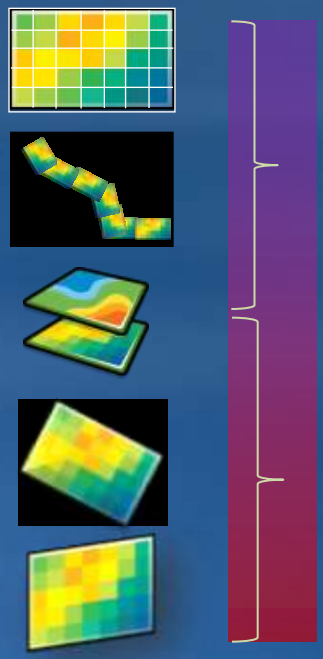
  "How do I process and serve imagery that we acquire?"



Catalog all available imagery
Make it quickly accessible in the required form

Wide Variety of Imagery

- Multiple Sources
  - Satellites, Aerial ,Terrestrial, Scanning
- Multiple Forms
  - Ortho Images Tiles
  - Image Strips
  - Processed Rasters
    - Elevation models / Lidar
    - Analysis results
    - Thematic maps
  - Scenes
  - Sensor Images
- Multiple Formats
  - TIF, NITF, JP2,…



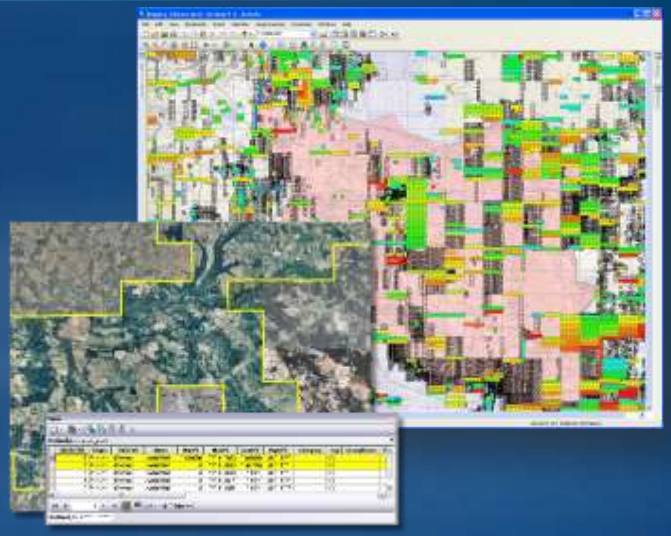
Procured as Background

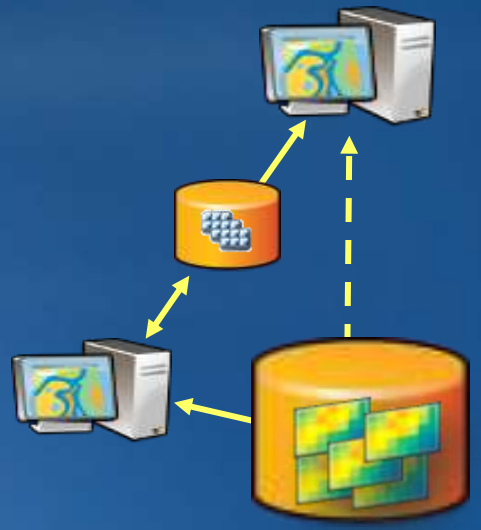
Acquired for Analysis

Mosaic Dataset

Optimum Model for Image Data Management

- Within ArcGIS Desktop
- Quickly Catalog
  - All raster datasets
  - Imagery from different sensors
- Define – In Geodatabase
  - Metadata
  - Processing to be applied
  - Default viewing rules
- Access – In all ArcGIS applications
  - As Image
    - Dynamic Mosaic , Processed on the fly
  - As Catalog
    - Footprints, Detailed metadata

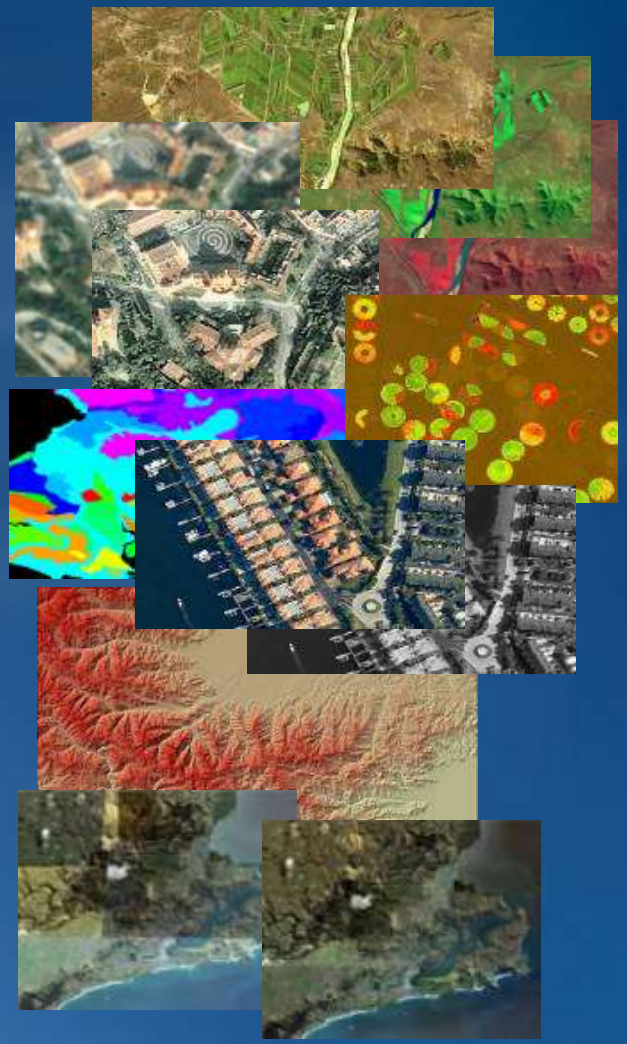




On-The-Fly Processing

Create Multiple Products from a Single Source

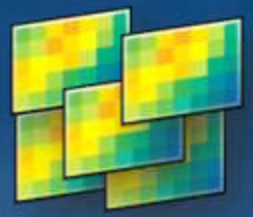
- Imagery processed as accessed
- Processes
  - Stretch, Extract Bands
  - Clip, Mask
  - Reproject, Orthorectify, Pan Sharpen
  - Vegetation Index, Classify
  - Shaded Relief, Slope, Aspect
  - Color Correction
  - …
- Applied to
  - Individual rasters in mosaic
  - Compete Mosaic Dataset



Utilizing the full image information content

Dynamic Mosaicking

Mosaicking Multiple Images On Demand



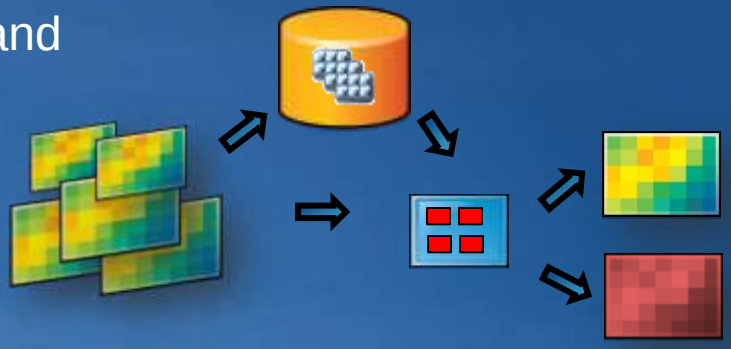
- Fuse imagery from multiple sources
- User control of Mosaic Method
  - By Date –'Latest', 'Closest to May 2001'
  - By Attribute – 'Highest Sun Angle'
  - By Viewpoint – North, South, East, West
  - Seamline – Feathered blend
- User Query – 'Landsat imagery, with no cloud, later than June 2001'
- Set default - Users sees best available imagery

Utilizing information from overlapping images

Enhancing Processing Methodologies

- Conventional Image Processing Workflows are Linear
  - Multiple processes create intermediate results
  - Products created as static mosaic

- Mosaic Datasets Enable Transactional Workflows
  - Processes applied on demand
  - Products created on demand

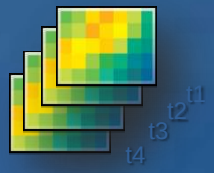


On-the-fly Processing & Dynamic Mosaicking

Resolves Traditional Image Management and Processing Issues

Processing Time
Reduces processing

Overlapping Imagery
Maintain information



Disparate Datasets
Large NoData areas

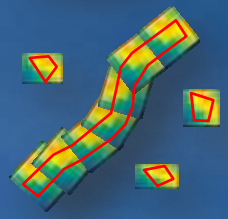
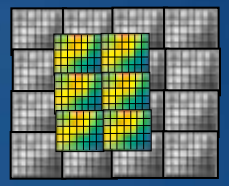


Image Quality
Reduces resampling

Storage
Reduces storage by removing redundancy

Multi-resolution Data
No need to sample up or down

Maintenance
Add imagery as required



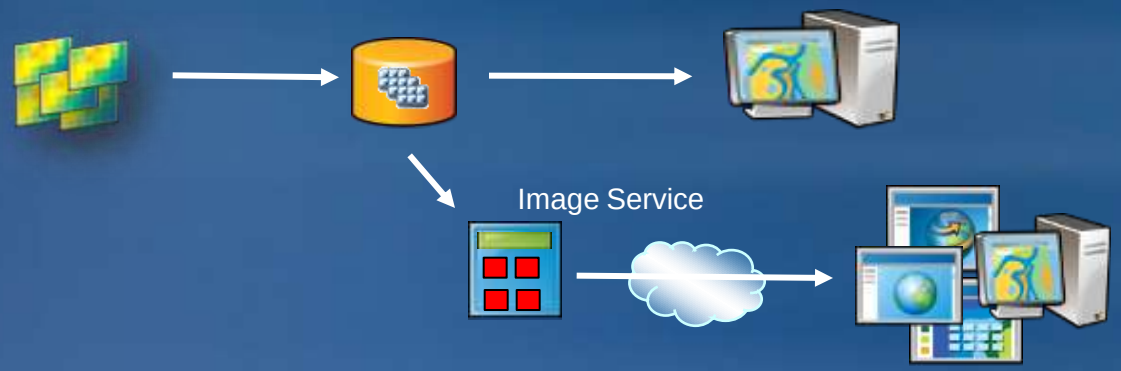
Maintain Metadata
Retain valuable information

Workflow overview

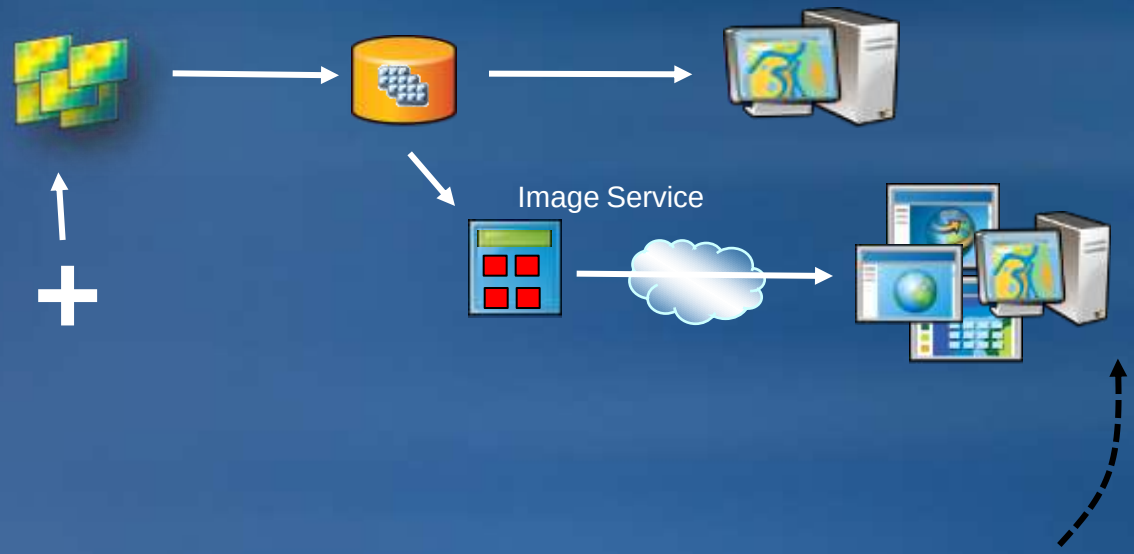
Workflow overview

Workflow overview

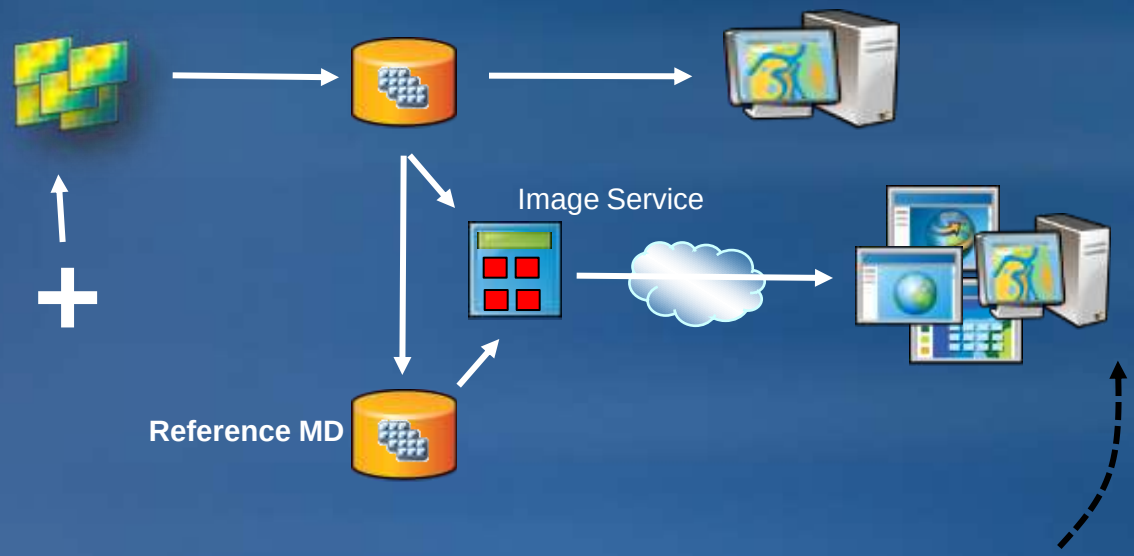
Workflow overview



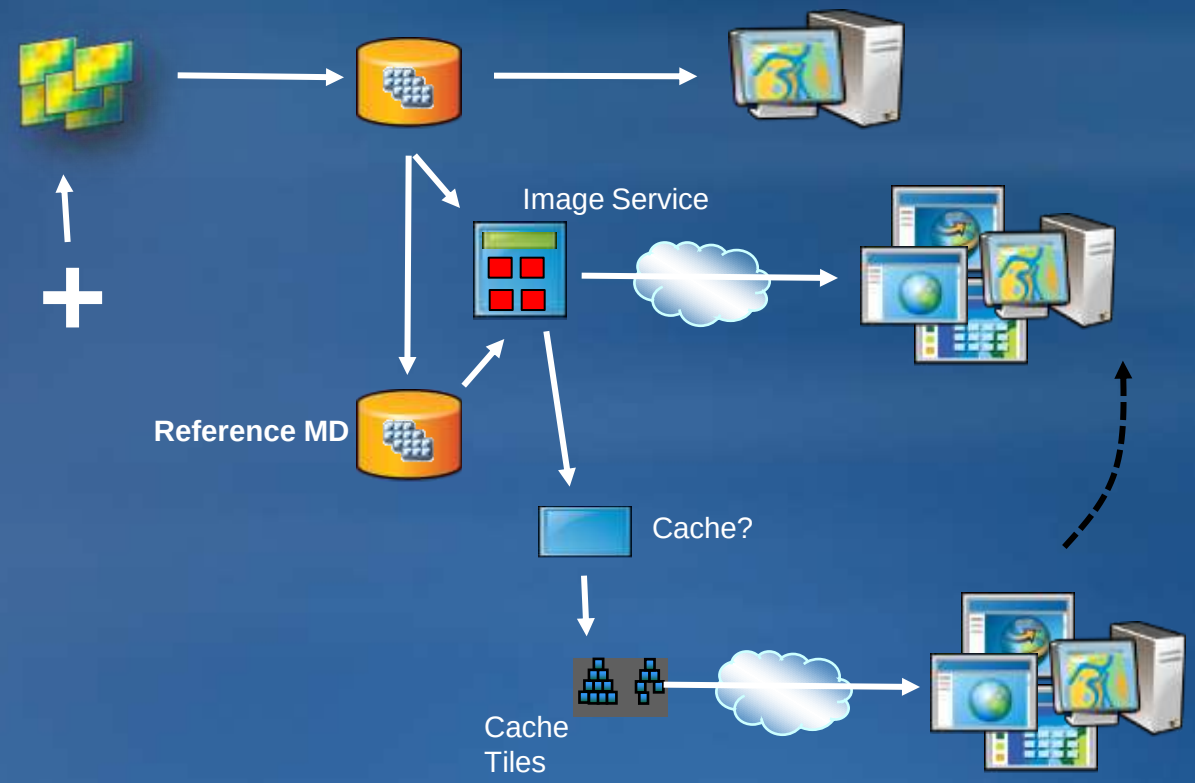
Workflow overview



Workflow overview



Workflow overview



Dissemination

Providing
Image Accessibility

Sharing: Direct, Static & Dynamic
Access: Multiple Clients

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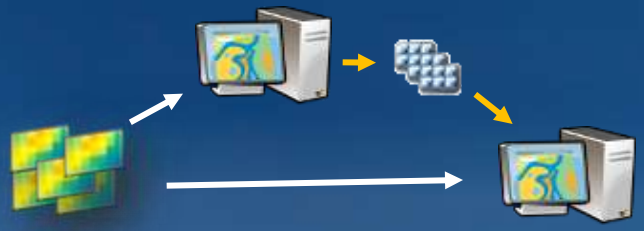
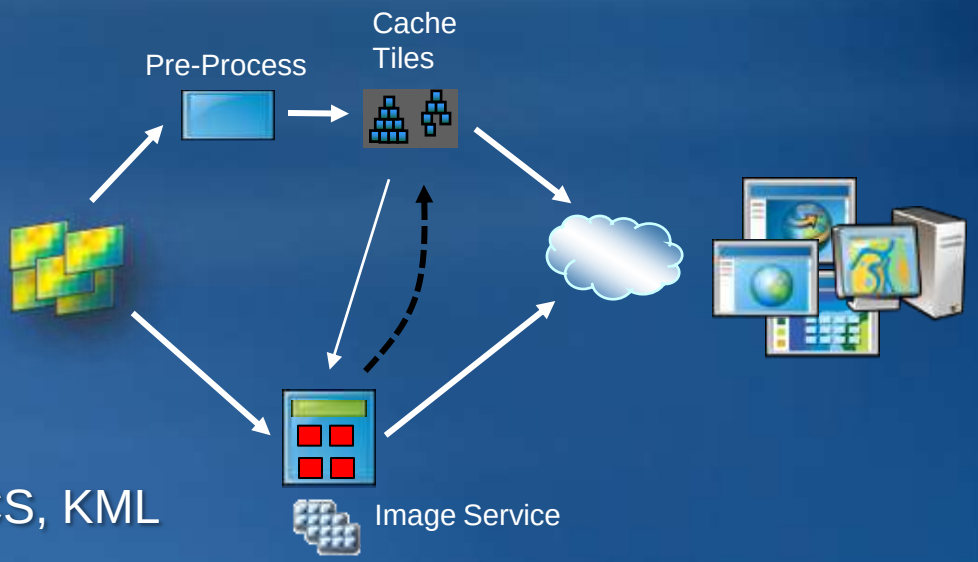
Image Accessibility

To Multiple Applications

- Direct Access
  - Raster
  - Mosaic Dataset
- Static Web Services
  - Map Cache
  - Compact Cache
  - JPGPNG
- Dynamic Image Services
  - Server based processing
  - Image Services, WMS, WCS, KML
  - SOAP, REST interfaces





ArcGIS provides image accessibility

Visualization

Interpretability of Imagery

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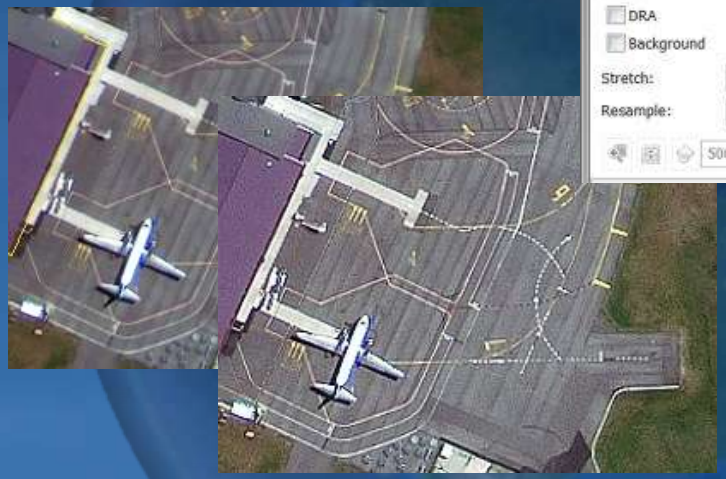
ArcGIS Desktop

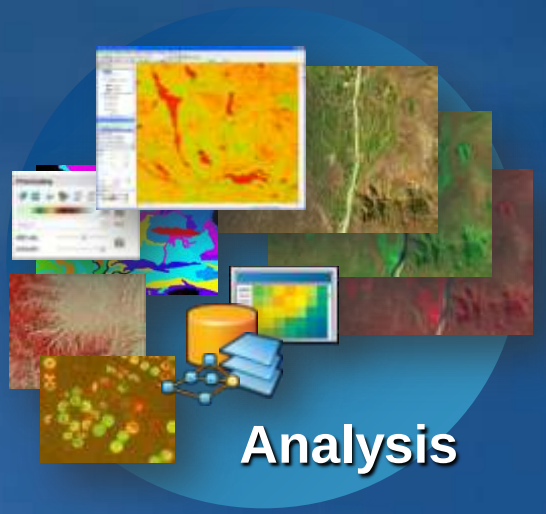
Seamless Pan and Zoom

- Electronic Light Table like display performance
- Integrated geospatial imagery and vectors
- Utilizes Hardware Acceleration
- Dynamic
  - Functions
  - Change: Contrast, Brightness, Gamma, DRA



Analysis

Exploiting the full value of imagery



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ArcGIS Desktop

Finding the Required Imagery

- Discovery
  - Simplified through Image Services
  - Best by default
  - User Query
  - User defined mosaic method
- Image Processing
  - Ortho, PanSharp, Composite
  - Mosaic
  - Applied On-The-Fly

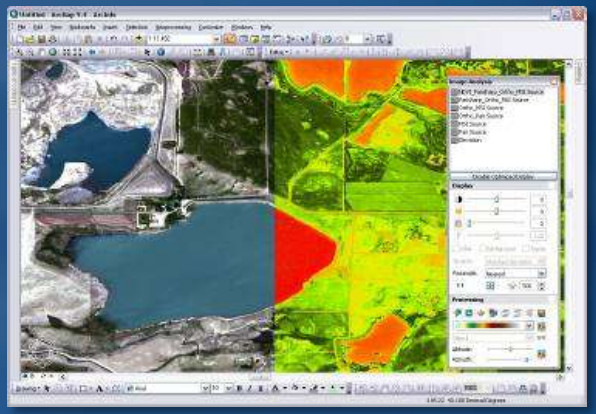
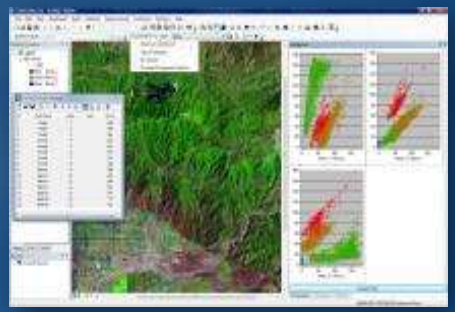


Image Classification Toolbar

Added to Spatial Analyst

- Training Sample Manager
  - Supervise & Unsupervised
  - Class Probability
  - Principle Component Analysis
- Define training areas graphically
- Generate Signature
- Apply Dynamically



ArcGIS – A Platform for Complete Imagery Solutions

Information Centric Workflows Enable Efficiency & Interoperability

- **ESRI works closely with its partners**
- **ArcGIS provides THE platform**
- **Partners provide domain expertise**

- Automated Feature Extraction
- Multispectral Analysis
- Hyperspectral Analysis
- Radar
- Specialized Sensor Support
- Stereo Display
- …

Trimble (Applanix)
Microsoft (Vexcel)
DigitalGlobe
Pictometry
RapidEye
GeoEye
SPOT

PCI Geomatics
Trimble (Inpho)
LizardTech
i-cubed
MDA

ITT VIS
Definiens
Clark Labs
Overwatch
BAE Systems

DAT/EM
PurVIEW
TerraGo
Qcoherent

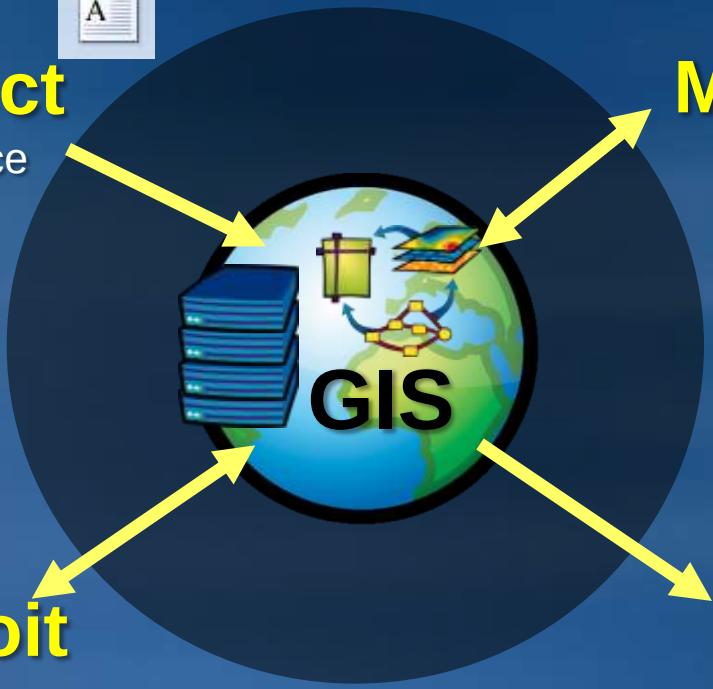
Service partners not listed

Information Centric Approach to Workflows

Making Workflows Transactional

Collect

From multiple source



Manage

Catalog, Metadata
Processing Parameters
Models

Exploit

Applications
What if
User customizable
Expose models
Geoprocessing services

Produce

Create standardized products
Catalogs
Report, Maps, WebServices

Enable Graded Products

ArcGIS

The Platform for Fully Integrated GIS and Imagery

- Integrating Imagery as core to GIS
- Management, Dissemination, Visualization and Analysis
- Solution for wide range of imagery requirements
- Maximizes the value of imagery